Politecnico di Torino

Digital systems electronics
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Lab 01

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1 Controlling the LEDs

The main purpose of the first point is to test the board and to get acquainted with the developing procedures for digital circuits on FPGAs using VHDL.
The task consisted in associate the 10 switches of DE1 board to its 10 LEDs. The simple combinational circuit was tested using Modelsim with a simple testbench that simulated every switch one by one.
Quartus prime was used for compiling and loading the project on the board.

2 2-to-1 Multiplexer

As figure 1 shows we are implementing a 2-to-1 Multiplexer using a stuctural approach. Since its internal implementation its pretty trivial we will not discuss it any further.

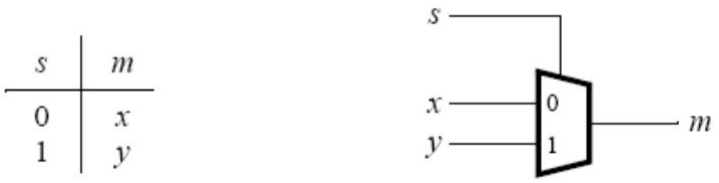

Figure 1: multiplexer + truth table

Its VHDL code has been written under Quartus prime. Than a testbench was developed under modelsim. In the testbench we fixed the two multplexed inputs and than varing the selection bit we checked the behaviour.

After the simulation was succesful we impoted the pin assignements into Quartus prime and after compiling and loading it on the board we verified the actual behaviour.

3 5-to-1 Multiplexer

We're now interested in designing the circuit shown in figure 2, where the output signal can be chosen between 5 different input signals with a 3 bit control signal as shown in the truth table.
The circuit model has been implemented using a behavioural approach, that leads to a faster but less customizable solution to design a 5 to 1 MUX.
The circuit has been proved to work thanks to a testbech simulation, checking the

s_2	s_1	s_0	m
0	0	0	u
0	0	1	v
0	1	0	w
0	1	1	x
1	0	0	y
1	0	1	y
1	1	0	y
1	1	1	y

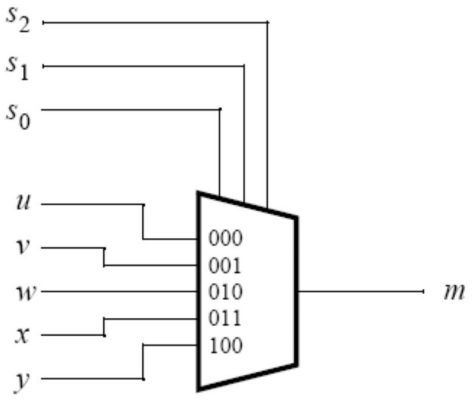

Figure 2: multiplexer + truth table

correspondence of input-output following the already cited truth table.
Finally the vhdl code has been loaded into the hardware fpga showing positive results as expected by simulation.